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Lamp

The invention relates to a lamp with a bulb that generates visible light and infrared light.

A lamp of this kind is known as a light source from DE 100 27 018 A1, and is used in a headlamp. The vehicle headlamp is equipped with a reflector, a lens and a shield, and operates in accordance with the projection principle. Light emitted by the lamp is reflected by the reflector. The shield and the lens are arranged in the beam path of a reflected light bundle. In the dipped operational position, the light bundle emitted from the headlamp in the visible wavelength range is a dipped-beam light bundle and illuminates a near range. The shield is at least partially permeable, at least over areas, to light in the infrared wavelength range. The light in the infrared wavelength range emitted through the shield is a main-beam light bundle, and illuminates a far range. The far range is registered by a sensor device and displayed for the vehicle driver by means of a display device.

It is an object of the invention to increase the output efficiency of a lamp for illuminating a far range with infrared light.

This object is achieved in accordance with the features claimed in claim 1. In accordance with the invention, the lamp bulb is equipped with a coating that reflects middle infrared radiation and is transparent to near infrared radiation. Infrared radiation is divided into near infrared radiation and middle infrared radiation. The filament is heated with the reflected middle infrared radiation, so the output efficiency of the lamp is increased. The near infrared radiation is emitted into a near range and a far range, and used for night-vision applications. The near and far ranges are hereby recorded by a sensor device and displayed for the vehicle driver by means of a display device. It is assumed that the sensor device requires essentially near infrared radiation but not middle infrared radiation for the purpose of the display.

In an advantageous manner, the lamp bulb has an elliptical shape. Owing to the elliptical shape, the middle infrared radiation is reflected evenly by the coating onto the filament.

In a simple manner, the coating has an interference coating with 37 individual layers of Nb_2O_5 and SiO_2.

In an advantageous manner, the lamp bulb is equipped with a coating that eliminates visible light. An unintentional dazzling of passers-by or oncoming traffic is thereby prevented.

In an advantageous manner, the lamp is equipped with an external bulb with the coating that eliminates visible light. The coating that eliminates visible light can be applied to an additional bulb in a simple manner.

In a simple manner, the coating is equipped with Fe_2O_3 and SiO_2 layers.

In an advantageous manner, the coating is arranged in a lower area of the bulb. The coating thereby acts as a barrier, which is arranged in a beam path to a lower reflector segment. The near and far ranges are illuminated with the near infrared radiation, and simultaneously, a dipped-beam light bundle is generated with visible light which illuminates a near range without oncoming traffic being dazzled.

In an advantageous manner, a lower reflector segment is equipped with an interference coating which reflects near infrared radiation and which is transparent to visible light. The lamp used in the headlight emits both near infrared radiation and visible light. The visible light is absorbed in the lower reflector segment. Visible light is thereby prevented in the far range, and oncoming traffic is not dazzled. The lamp itself is equipped with only one coating, which reflects middle infrared radiation and is permeable to near infrared radiation.

The invention will be further described with reference to examples of embodiments shown in the drawings, to which, however, the invention is not restricted.

Fig. 1 shows a lamp with an internal and an external bulb for generating an infrared main-beam and dipped-beam light bundle in schematic sectional view.

Fig. 2 shows a diagram in which a reflection of a coating is plotted against a wavelength.

Fig. 3 shows a diagram in which a transmission of a coating that blocks visible light and allows infrared light through, is plotted against a wavelength.

Fig. 4 shows a second lamp with an internal and an external bulb for generating an infrared main-beam light bundle and a visible dipped-beam light bundle in schematic sectional view.

Fig. 5 shows the lamp as used in a reflector.

Fig. 6 shows a headlamp with a third lamp and a second reflector in schematic sectional view.

Fig. 7 shows the headlamp in schematic plan view.

Fig. 1 shows a lamp 1 with a filament 2, electrically conductive feed wires 3 and 4, an internal bulb 5 and an external bulb 6. Applied to an external surface 7 of the internal bulb 5 is a coating 8, which reflects middle infrared radiation and allows near infrared radiation to pass through. The coating 8, which is applied to the elliptical internal bulb 5, reflects middle infrared radiation onto the filament 2 in order to increase the efficiency of the lamp.

The coating 8 is equipped with a total of 37 layers, specifically, starting from the surface of the lamp bulb, a first 170.94 nm thick layer of Nb_2O_5, then a second 189.40 nm thick layer of SiO_2, then a third 133.29 nm thick layer of Nb_2O_5, a fourth 229.68 nm thick layer of SiO_2, a fifth 146.3 nm thick layer of Nb_2O_5, a sixth 258.26 nm thick layer of SiO_2, a seventh 167.24 nm thick layer of Nb_2O_5, an eighth 242.48 nm thick layer of SiO_2, a ninth 152.63 nm thick layer of Nb_2O_5, a tenth 280.44 nm thick layer of SiO_2, an eleventh 205.76 nm thick layer of Nb_2O_5, a twelfth 304.82 nm thick layer of SiO_2, a thirteenth 226.07 nm thick layer of Nb_2O_5, a fourteenth 277.54 nm thick layer of SiO_2, a fifteenth 172.17 nm thick layer of Nb_2O_5, a sixteenth 357.67 nm thick layer of SiO_2, a seventeenth 210.09 nm thick layer of Nb_2O_5, an eighteenth 348.82 nm thick layer of SiO_2, a nineteenth 180.54 nm thick layer of Nb_2O_5, a twentieth 509.90 nm thick layer of SiO_2, a twenty-first 152.30 nm thick layer of Nb_2O_5, a twenty-second 519.34 nm thick layer of SiO_2, a twenty-third 145.95 nm thick layer of Nb_2O_5, a twenty-fourth 506.86 nm thick layer of SiO_2, a twenty-fifth 163.68 nm thick layer of Nb_2O_5, a twenty-sixth 447.11 nm thick layer of SiO_2, a twenty-seventh 183.42 nm thick layer of Nb_2O_5, a twenty-eighth 443.45 nm thick layer of SiO_2, a twenty-ninth 170.87 nm thick layer of Nb_2O_5, a thirtieth 518.88 nm thick layer of SiO_2, a thirty-first 153.59 nm thick layer of Nb_2O_5, a thirty-second 573.54 nm thick layer of SiO_2, a thirty-third 387.73 nm thick layer of Nb_2O_5, a thirty-fourth 557.49 nm thick layer of SiO_2, a thirty-fifth 165.28 nm thick layer of Nb_2O_5, a thirty-sixth 543.59 nm thick layer of SiO_2, and a thirty-seventh 379.59 nm thick layer of Nb_2O_5.

Applied to an external surface 9 of the elliptical external bulb 6 is a second coating 10, which eliminates visible light so that the lamp 1 illuminates a near and a far range with near infrared light. The near and far range can then be viewed using a night-vision device.

The second coating is equipped with a total of twelve layers, specifically, starting from a surface of the lamp bulb, a first 38.82 nm thick layer of Fe_2O_3, then a second 99.9 nm thick layer of SiO_2, then a third 47.06 nm thick layer of Fe_2O_3, a fourth 102.39 nm thick layer of SiO_2, a fifth 228.8 nm thick layer of Fe_2O_3, a sixth 97.78 nm thick layer of SiO_2, a seventh 58.95 nm thick layer of Fe_2O_3, an eighth 100.39 nm thick layer of SiO_2, a ninth 52.29 nm thick layer of Fe_2O_3, a tenth 97.97 nm thick layer of SiO_2, an eleventh 223.1 nm thick layer of Fe_2O_3, and a twelfth 194.75 nm thick layer of SiO_2.

Fig. 2 shows a diagram in which a reflection of the first coating 8 is plotted against a wavelength. The coating 8 is permeable to near infrared radiation, NIR for short, lying within a range of 800 to 1000 nm, and reflective of middle infrared radiation, MIR for short, lying within a range of 1000 nm and above. The coating 8 is permeable, at least in part, to visible light.

Fig. 3 shows a diagram in which a transmission of the second coating 10 is plotted against a wavelength. The coating absorbs visible light, VIS for short, lying within a range of 400 to 800 nm, and is permeable to near and middle infrared radiation.

Figs. 4 and 5 show a second lamp 21, used in a reflector 22. The lamp 21 is equipped with an internal bulb 23 and an external bulb 24, which is partially coated. The internal bulb is equipped with the coating 8, which reflects middle infrared radiation back onto the filament 25 so that the filament 25 is additionally heated. The coating 8 is permeable to near infrared radiation. The external bulb 24 is equipped with the coating 10 in a lower bulb area 26. The coating 10 eliminates visible light and is permeable only to near infrared radiation. This near infrared radiation falls upon a lower reflector segment 27, which emits the near infrared radiation as a main-beam light bundle into a far range.

In other words: in order to generate near infrared light bundles and a visible dipped-beam light bundle, a lamp 21 is used, which is partially enclosed by a barrier 10, which is permeable to infrared light and blocks visible light. This barrier 10 is arranged, as a partial coating 10, on the glass bulb 24 which envelops the lamp 21, in a beam path between the filament 25 and the lower reflector segment 27, and filters out visible light, so that only a near-infrared main-beam light bundle is generated by the lower reflector segment 27. An upper reflector segment 28 serves to generate the visible dipped-beam light bundle. The lamp 21 and the reflector 22 are component parts of a headlamp 21, 22.

Figs. 6 and 7 show a headlamp 31 with a lamp 32 whose filament 33 is arranged in a focal point of a reflector 34. The lamp 32 is equipped, on a lamp bulb 35, with the coating 8, which is permeable to visible light and near infrared radiation, and reflects

middle infrared radiation back onto the filament 33. A beam 37 and 38 falling onto an upper reflector segment 36 generates a visible dipped-beam light bundle 37 and 38, which additionally includes near infrared radiation. A lower reflector segment 39 is equipped with an interference coating 40, which reflects near infrared radiation and absorbs visible light. The reflector segment 39 ensures an elliptical distribution of the near infrared radiation in a plane parallel to the road and is thus optimized for a night-vision application. As an alternative, a coating 40, which is permeable to visible light and reflects infrared radiation, is arranged on a surface 41 of a lower reflector segment 39 that has been optimized for infrared illumination.

LIST OF REFERENCE NUMBERS

1	Lamp
2	Filament
3	Electrically conductive feed wire
4	Electrically conductive feed wire
5	Internal bulb
6	External bulb
7	Surface
8	Coating
9	Surface
10	Coating
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	Lamp
22	Reflector
23	Internal bulb
24	External bulb
25	Filament
26	Lower area
27	Reflector segment
28	Reflector segment
29	
30	

31	Headlamp
32	Lamp
33	Filament
34	Reflector
35	Bulb
36	Reflector segment
37	Beam
38	Beam
39	Reflector segment
40	Coating
41	Surface
42	
43	
44	
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